****

NAVFAC **IGS-09310 (JUNE 2003)**

Supersedes IGS-09310 (05/02)

Preparing Activity: LANTNAVFACENGCOM **Based on UFGS-09310N**

ITALIAN GUIDE SPECIFICATIONS

Use for ITALIAN projects only

****

SECTION 09310

CERAMIC TILE, PORCELAIN TILE, QUARRY TILE, AND PAVER TILE

06/03

****

NOTE: This guide specification is issued by the Atlantic Division, Naval Facilities Engineering Command for regional use in Italy.

****

****

NOTE: This guide specification covers the requirements for tile work including tile set and grouted with epoxy or furan adhesives. This guide specification does not cover conductive tile for surgical and obstetrical suites in hospitals; tile for swimming pools; tile for exterior applications; tile work in refrigerated rooms or spaces; and metal or plastic tile. Use Section UFGS-09331N, "Chemical-Resistant Quarry Tile," when chemical-resistant quarry tile flooring is required.

UFGS-09331N covers the requirements for quarry tile with chemical-resistant grout and setting bed for use in medium to large dining facilities and other areas subject to spillage of acids or other chemicals. Rooms, areas, or spaces where chemical-resistant quarry tile floors are to be provided include: The areas under ranges, kettles, and ovens, within disk-and-pot-washing areas, food-preparation areas, serving areas, and garbage rooms.

****

****

NOTE: On the drawings, show:

1. Floors, walls, wainscots (give heights) to be tiled, shower rooms and compartments, countertops and back splashes.

2. Bases, thresholds, and treatment at windows,

doors and trimmed openings, including sills and vertical returns back to window or door frames.

3. Extent of cleavage membranes or membrane waterproofing.

4. Provide enlarged details of all cross sections of mortar beds, detail where surface of tile is to be flush with adjacent floor, indicate depressed structural slab or sub-floor.

5. Schedule showing tile types, sizes, patterns, colors, trim, and built-in accessories required for each room or space.

6. Slope of floors to drain.

7. Details and locations of expansion and control joints.

8. Treatment at tile recesses for radiators, convectors, drinking fountains, lighting fixtures, and other recessed items.

9. Locations where walls are to be furred for wall tile.

****

****

NOTE: Comments and suggestion on this specification are welcome and should be directed to the technical proponent of the specification. A listing of the technical proponents, including their organization designation and telephone number, is on the Internet.

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

****

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A108.1	(1992) Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar

ANSI A118.1	(1992) Dry-Set Portland Cement Mortar (Available only as part of ANSI A108.1)
ANSI A118.3	(1992) Chemical-Resistant, Water-Cleanable Tile-Setting and Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive (Available only as part of ANSI A108.1)
ANSI A118.4	(1992) Latex-Portland Cement Mortar (Available only as part of ANSI A108.1)
ANSI A118.6	(1992) Ceramic Tile Grouts

ITALIAN NATIONAL ASSOCIATION FOR UNIFICATION OF STANDARDS (UNI)

****

NOTE: A UNI Norm is a technical normative recognized as Italian Law, submitted by a private organization "Ente Nazionale Italiano di Unificazione" for Italy and is available only in the Italian language. It is the National Standard.

****

UNI 8520-22	(1999) Aggregates for use in concrete - Determinaton of potential reactivity of alcali in aggregates

ITALIAN/EUROPEAN HARMONIZATION STANDARDS (UNI EN)(UNI ENV)(UNI EN ISO)

****

NOTE: A UNI EN, UNI ENV, CEI EN, UNI EN ISO or UNI ISO is a Eurpoean Standard with a coincident Italian National Standard or International Standard. The two standards are identical, with most (but not all) EN's available in the English language and the UNI available only in the Italian language.

****

UNI EN 87	(1991) Ceramic Floor and Wall Tiles - Definitions, Classification, Characteristics and Marking
UNI EN 197-1	(2001) Cement - Composition, Specifications and Conformity Criteria - Part 1: Common Cements
UNI EN 932-3	(1996) Tests for General Properties of Aggregates - Part 3: Procedure and Terminology for Simplified Petrographic Description
UNI EN 10142	(1990) Continuously Hot-Dip Zinc Coated

	Low Carbon Steel Sheet and Strip for Cold Forming - Technical Delivery Conditions
UNI EN 1015-11	(2001) Method of Test for Mortar for Masonry Part II: Determination of Flexural and Compressive Strength of Hardened Mortar
UNI EN 12004	(2001) Ceramic Tile Adhesives - Minimum Requirements
UNI ENV 459-1	(1996) Building Lime - Part 1: Definitions, Specifications and Conformity Criteria
UNI ENV 459-2	(1996) Building lime - Part 2: Test methods
UNI ENV 10080	(1997) Steel for the reinforcement of concrete - Weldable ribbed reinforcing steel B 500 - Technical delivery conditions for bars, coils and welded fabric
UNI EN ISO 10545-1	(2000) Ceramic Tiles. Samplng and Basics for acceptance

1.2 SUBMITTALS

****

NOTE: Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item is required.

A “G” following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a “G”. Only delete an existing “G” if the submittal item is not complex and can be reviewed through the Contractor’s Quality Control system. Only add a “G” if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Recommended codes for Army projects are "RE" for Resident Engineer approval, "ED" for Engineering approval, and "AE" for Architect-Engineer approval. Codes following the "G" typically are not used for Navy projects.

Submittal items not designated with a "G" are considered as being for information only for Army projects and for Contractor Quality Control approval for Navy projects.

****

Submit the following in accordance with Section 01330 "Submittal Procedures."

SD-04 Samples

Ceramic floor tile; G

300 mm square sheetsmounted showing colors, finish, pattern, and form of each type, with joints between the tiles grouted.

[Quarry] [Paver] floor tile; G

Sets of four tiles showing finish, size, and range of shades in each color, with joints between the tiles grouted.

Ceramic wall tile; G

Sets of [four tiles] [ceramic mosaic sheet] showing size, form, finish, and range and shades in each color, with joints between the tiles grouted.

Ceramic tile trim units; G

Pieces of each unit, showing color, finish, and type.

Ceramic tile accessories; G

Pieces of each type, showing color, finish, type, and style.

****

NOTE: Porcelain ceramic tiles are high strength tiles that are durable and particularly suitable for wet areas. These tiles can be used for both interior and exterior floorings and wall applications. The finished surface can be colored, natural, matte, polished, vitreous and non-slip textured for wet floor areas.

****

Porcelain ceramic floor tile; G

Porcelain ceramic wall tile; G

Porcelain ceramic tile trim units; G

Porcelain ceramic tile accessories; G`

1.3 DELIVERY, STORAGE, AND HANDLING

UNI EN ISO 10545-1. Deliver materials in manufacturer's original sealed containers. Labels shall be legible and intact identifying brand name and contents. Examine content for damaged, chipped or broken tiles, and set aside or identify containers for replacement of defective tiles. Manufactured mortars and grouts (in bags) shall contain manufacturer's recommendation for mix and application. Store bags under cover and protected from the weather in manner to prevent damage, contamination, or contact with water.

1.4 ENVIRONMENTAL CONDITIONS

Close space, in which tile is being set, to traffic and other work. Keep closed until tile is firmly set. Do not walk on, nor work on newly tiled floors without using kneeling boards or equivalent protection of the tiled surface. Keep traffic off horizontal portland cement mortar installations for at least 72 hours. Keep all traffic off epoxy installed floors for at least 40 hours after grouting, and heavy traffic off for at least 7 days, unless otherwise specifically authorized by manufacturer.

Do not start tile work unless the ambient temperature in work area is at least 10 degrees C and rising. Maintain the ambient temperature above 10 degrees C while work is in progress and for at least 3 days after its completion. Do not use adhesives in unventilated areas. [For the installation and subsequent cure of chemical-resistant epoxy mortars, the temperature shall be at least 16 degrees C and rising for a period of time recommended by the manufacturer. Temperature of substrate shall be 16 C and rising for application of epoxy unless otherwise specifically authorized by its manufacturer. Maintain epoxy at a stable temperature between 16 C and 32 C during the curing period.]

1.5 EXTRA STOCK

Supply an extra two percent of each type tile used in clean and marked cartons.

PART 2 PRODUCTS

2.1 MATERIALS

Floor tile shall be thoroughly and evenly cured and free from defects which affect appearance or serviceability. Tile with chips, cracks, or defects will not be acceptable. All tiles shall conform for quality of material and workmanship to the applicable UNI EN 87 standards.

2.1.1 Product Manufacturers

The following manufacturers make slip-resistant, cushion edge, and stain resistant floor tile products that generally comply with these specifications:

a. Marazzi Ceramiche S.p.A.
Viale Regina Pacis, 39
41049 Sassuolo (Modena)
Tel. : 0536/860274

Fax : 0536/860599
E-Mail-: marazzi.tecnica@marazzi.it

b. Granitifiandre S.p.A.
Via Radici Nord
42014 Castellarano (Reggio Emilia)
Tel. : 0536/819611
Fax : 0536/850088-858082

c. Granitogres
Ceramica Casalgrande Padana
Via Statale, 73
42013 Casalgrande (Reggio Emilia)
Tel. : 0522/9911
Fax : 0522/996121

d. Ceramica Floor Gres S.p.A.
Via Comunale del Canaletto, 24
41042 Fiorano Modenese (Modena)
Tel. : 0536/840111
Fax : 0536/844750

The following manufacturers make wall tile products that generally comply with these specifications:

a. Appiani Industrie Ceramiche Riunite S.p.A.
Via Pordenone, 13
31046 Oderzo (Treviso)
Tel. : 0422/815308
Fax : 0422/814026

b. Cerim Ceramiche S.p.A.
40027 Mordano (Bologna)
Tel. : 0542/57111
Fax : 0542/51049

c. Gabbianelli S.r.l.
Via Alessandrina, 45
20095 Cusano Milanino(Milano)
Tel. : 02/6197783
Fax : 02/6135063

d. Ce.Si.
Ceramica di Sirone S.p.A.
Via Don Minzoni, 19
22040 Sirone (Como)
Tel. : 031/850058
Fax : 031/852468

e. Iris Ceramica
Via Ghiarola Nuova, 119
Zona Industriale I
41042 Fiorano Modenese (Modena)
Tel. : 0536/862111-802861

Fax : 0536/804602-802255

The following manufacturers make cement mortars, grouts and adhesives for tile setting that generally comply with these specifications:

a. MAPEI S.p.A.
Via Cafiero, 22
20158 Milano
Tel. : 02/376731
Fax : 02/37673214
E-Mail: mapei@inferentia.it

b. KERAKOLL S.p.A.
Via dell'Artigianato, 9
41049 - Sassuolo (Modena)
Tel. : 0536/816511
Fax : 0536/800202

2.1.2 Tile

****
NOTE: When colors and patterns are identified by a manufacturer's name and designations, include the bracketed sentence. If the "architectural finishes display board" is used, it must be on display in the Contracting Officer's office. The board should only be used to supplement the information in the drawings and specifications.
****

Ceramic and porcelain floor and wall tiles shall comply with UNI EN 87.

2.1.2.1 Color and Patterns

Tile colors and patterns shall be [as indicated] [and as on the architectural finishes display board] [as selected from the manufacturer's standard color samples]. [Colors and patterns indicated by reference to manufacturer's name and designations are for color and pattern identification only and are not intended to limit selection of other manufacturer's products with similar colors and patterns.]

2.1.2.2 Floor Tile

****
NOTE: Either specify locations for slip-resistant tile, or ensure that the locations of slip-resistant tile are shown on the project drawings. Slip-resistant ceramic mosaic tile is available in 25 by 25 mm nominal size only. Slip-resistant quarry tile should be specified for areas where food and water spillage cause the floors to be slippery and hazardous (e.g., dishwashing areas, sculleries, food-preparation areas, photo labs or any areas subject to moisture or other lubricants).

****

a. Unglazed ceramic mosaic tile: UNI EN 87, Group III porcelain ceramic or natural clay with cushioned edges.

Nominal Facial Dimensions in millimeters:	Nominal Thickness in millimeters:
[25 by 25] [50 by 25] [50 by 50]	[6] [8] [10] [15]

[Slip resistant: The body of the tile shall have a content of 7.5 plus or minus-percent by weight of abrasive grains. Provide in the following areas: [shower [rooms] [stalls]] [and [_____].]

Mounted tile for use in wet areas (pools, showers, exteriors) shall be either face-mounted or dot-mounted and shall be recommended by the manufacturer for use in wet areas. Do not use paper back-mounted or net back-mounted tile in wet locations.

b. [Unglazed] [Glazed] Quarry tile floor: UNI EN 87, Group IIa or IIb, square edges, with [plain] [grooved] [figured] face.

Nominal Facial Dimensions in millimeters:	Nominal Thickness in millimeters:
[75 by 75] [100 by 100] [150 by 150]	[8] [9]
[200 by 100] [200 by 200]	[8] [8,5] [15]
[150 by 150] [200 by 100]	[8]

[Slip resistant: Impregnate an abrasive aggregate into the face of the tile. The aggregate shall be aluminum oxide or other rustproof abrasive, and be 50 to 150 percent of grains of the approved sample. Provide in the following areas: [sculleries] [kitchens] [and [_____].]

c. [Unglazed] [Glazed] Ceramic Tile: UNI EN 87, Group IIb

Nominal Facial Dimensions in millimeters:	Nominal Thickness in millimeters:
[100 by 100] [150 by 150]	[8] [10] [11]
[100 by 200] [200 by 200]	[8] [10]
[300 by 300] [400 by 400]	[8] [10]

d. [Unglazed] [Matt] [Glazed] Porcelain Ceramic Tile: UNI EN 87 GROUP IIa.

Nominal Facial Dimensions in millimeters:	Nominal Thickness in millimeters:
[80 by 80] [200 by 200]	[8] [9] [11]
[300 by 300] [400 by 400]	[10]
[600 by 600] [600 by 900]	[10]

2.1.2.3 Wall Tile

a. Glazed wall tile: UNI EN 87 Group IIa, [bright] [matte] finish with cushioned edges.

Nominal Facial Dimensions in millimeters:	Nominal Thickness in millimeters:
[108 by 108] [150 by 108] [150 by 150]	[8]

b. Glazed ceramic mosaic tile: UNI EN 87 Group IIb, porcelain ceramic or natural clay with cushioned edges.

Nominal Facial Dimensions in millimeters:	Nominal Thickness in millimeters:
[25 by 25] [50 by 25] [50 by 50]	[6][8] [10] [15]

c. [Unglazed] [Glazed] Porcelain Ceramic Tile: UNI EN 87 Group IIa.

Nominal Facial Dimensions in millimeters:	Nominal Thickness in millimeters:
[80 by 80] [200 by 200] [300 by 300] [400 by 400]	[8] [9] [11]

2.1.2.4 Trim Units

Provide matching trim units [and accessories] with tile work. Provide where indicated for a complete and finished installation. Provide bullnose units for wainscots, except where wainscot is flush with abutting wall surface. Provide up-and-down corners with bullnose units where there is a break in wainscot height, or where the wainscot does not terminate against projecting construction. Provide [coved] base units for wainscots, and 100 mm [coved] base units for tile floors where wainscots are not provided. Internal corners shall be squared and external corners rounded using appropriate matching trim units.

[2.1.2.5 Accessories

****
NOTE: Specify metal bathroom accessories, including metal grab bars, in Section 10800, "Toilet and Bath Accessories."
****

Built-in ceramic type, same materials and finish as glazed wall tile. [Locations for accessories which are specified but not indicated, shall be as directed by the Contracting Officer.] Provide the following accessories:

	Quantity	[Location]
a. Recessed soap holders	[_____]	[_____]
b. Tumbler holders	[_____]	[_____]
c. Combination tumbler and toothbrush holders	[_____]	[_____]
d. Towel bars, [ceramic] [600] [750] mm long, two towel posts	[_____]	[_____]
e. Robe hooks	[_____]	[_____]
f. Roll paper holder	[_____]	[_____]
g. Recessed soap holder and hand hold combination: support static load of 1.1 kn UNI 8927	[_____]	[_____]

]2.1.3 Hydrated Lime

UNI ENV 459-1, and UNI ENV 459-2 Hydrated Calcium Lime Type (Calcium Hydroxide).

2.1.4 Aggregate

UNI EN 932-3, and UNI 8520-22 except sand particles for grout shall have a maximum granulometry of 2 mm diameter.

2.1.5 Water

Clean, potable.

2.1.6 Portland Cement

UNI ENV 197-1, CEM I, white for grout, gray for other uses.

2.1.7 Latex Additive

****

NOTE: Retain subparagraph below if latex additive is required to improve flexibility and other properties of mortar setting bed.

****

Styrene butadiene rubber latex additive (water emulsion), serving as replacement for part or all of gaging water, of type specifically recommended by latex additive manufacturer for use with job-mixed Portland cement and aggregate mortar bed and grout. Add at project site during mixing operations in accordance with manufacturers recommendations.

2.1.8 Membrane and Cleavage Membrane

2.1.8.1. Water Proofing Membrane

Elastomeric or plastometric sheet with a minimum thickness of 0.10 mm or as recommended by the tile manufacturer.

2.1.8.2 Cleavage Membrane

As recommended by the tile manufacturer.

2.1.9 Reinforcing Wire Fabric

UNI ENV 10080, [50 by 50 mm fabric, 1.59/1.59 wire] [75 by 75 mm fabric, 2.32/2.32 13/13 wire] [38 by 50 mm fabric, 1.59/2.32 wire], in flat sheets only.

2.1.10 Metal Dividing Strips

Heavy-top terrazzo type, brass or zinc alloy, approximately 2 mm thick with 6 mm thick top, and depth equal to thickness of tile plus setting bed.

2.1.11 Thresholds

Hard, sound, domestic [marble] [slate] [stone], minimum 25 mm thick for mud bed application and 13 mm thick for thin-set application, unless indicated otherwise. Round edges exposed to foot traffic. Sand-rubbed finish on exposed surfaces. Bevel vertical edges to maximum of 13 mm in height or as indicated. Color shall be [white] [gray].

2.1.12 Window Stools

Hard, sound, domestic marble, not less than 22 mm thick, with polished finish on exposed surfaces. Color shall be [white] [gray]. Exposed edges and corners shall be slightly rounded.

2.1.13 Mortars and Grouts

****
NOTE: Remove the types of Mortars and Grouts that are not used on this Facility from the following two paragraphs.
****

****
NOTE: Scratch coat for ceramic tile should be specified in this section if there is no other plaster work in the project. Refer to EN 480-2 for guidance. If specified in this section, delete the cross reference to another section.
****

****
NOTE: The epoxy system included in this specification is to be used where chemical resistance may not be the primary or only

performance criterion desired. It can be used where good stain resistance, water resistance, and mild chemical resistance is required in areas such as dining rooms, photographic dark rooms, public toilets and foyers. If a chemical-resistant tile floor is desired, use "Chemical-Resistant Quarry Tile Flooring." Epoxy grout and mortar should not be used in environments where temperature is over 54 degrees C.

****

2.1.13.1 Mortar and Adhesives Tile Setting

Mortars shall have a minimum shear strength of 3.5 N/sq. mm and a minimum compressive strength of 8.0 N/sq. mm, in accordance with UNI EN 1015-11.

a. Portland cement mortar: ANSI A108.1 or UNI EN 12004, Type C, Class 1, [white] [gray].

(1) Proportions for Scratch and Leveling Coat of Walls and Ceilings:

The mix for scratch and leveling coats for application to metal lath, concrete and masonry surfaces shall be as follows:

1-part portland cement, 1/2-part hydrated lime and 4-parts dry sand or 5-parts damp sand by volume: or 1-part portland cement and 3-parts dry sand or 4-parts damp sand by volume.

(2) Proportions for Walls and Ceilings Mortar Bed Mix (Float Coat):

From 1-part portland cement, 1/2-part hydrated lime and 5-parts damp sand to 1-part portland cement, 1-part hydrated lime and 7-parts damp sand, by volume.

(3) Proportions for Floor Mortar Bed Mix:

1-part cement, 5-to 6-parts damp sand, and optionally, up to 1/10-part hydrated lime by volume.

b. Dry-set portland cement mortar: ANSI A118.1 or UNI EN 12004, Type C, Class 1, factory sanded.

c. Latex-portland cement mortar: ANSI A118.4 or UNI EN 12004, Type D, Class 1.

d. Chemical-resistant, water-cleanable, tile-setting and grouting epoxy: ANSI A118.3 or UNI EN 12004, Type R, Class 1.

2.1.13.2 Grout

Factory prepared mixtures requiring only the addition of water at the job-site prior to application. The product density is of at least 1.30 g/cu.cm with a bonding strength after 28 days of 1.4 N/sq. mm, flexural

strength of 3.5 N/sq. mm and compressive strength 8.0 N/sq. mm.

****

NOTE: Grout should be compatible with mortar system. Hot or windy weather may cause latex-portland cement mortar to prematurely skin over, resulting in loss of bond to the tile. If environmental conditions are warranted, provide Contractor the option of using either dry-set portland cement mortar or latex-portland cement mortar.

****

a. Commercial portland cement: ANSI A118.6 or UNI EN 12004, Type C, Class 1.

b. Sand portland cement: ANSI A118.6 or UNI EN 12004, Type C, Class 1.

(1) On-the-job-mixture of 1-part portland cement to 1-part fine graded sand is used for joints up to 3.17 mm wide: 1-part portland cement to 2-parts fine graded sand for joints up to 12.7 mm wide; 1-part portland cement to 3-parts fine graded sand for joints over 12.7 mm. Up to 1/5 part lime may be added.

c. Dry set: ANSI A118.6 or UNI EN 12004, Type C, Class 1, factory sanded.

d. Latex-portland cement: ANSI A118.4 or UNI EN 12004, Type D, Class 1.

e. Chemical-resistant, water-cleanable, tile-setting and grouting epoxy: ANSI A118.3 or UNI EN 12004, Type R, Class 1.

2.1.14 Sealants and Calkings

Provide sealants and calkings in joints between tile and [bathtubs] [shower receptors] as specified in Section 07920, "Joint Sealants."

[2.1.15 Scratch Coat

Apply scratch coat and allow to dry slowly for not less than 24 hours before tile is to be set. Apply in the thickness indicated or as necessary to bring the face of the tile to the required plane, but not less than 6 mm from the face of the material it is being applied to. Scratch coat shall have a level surface within a tolerance of 2.5 millimeters per meter. Apply scratch coat after substantial grounds, plugs, hangers, and other such accessories have been installed for plumbing fixtures, electrical outlets, and other fixtures and fittings that are to be secured to tile surfaces. Apply scratch coat with sufficient pressure to insure a proper bond and key with the base and a proper base for the setting bed. While the mortar is still plastic, cut the scratch coat with a trowel at internal vertical angles for depth of the coat and the full height of the tile bed. Score horizontally or cross-scratch on 25 mm centers for the extent of the

tile bed. Use mortar for scratch coats within one hour after mixing. Do not retemper. Protect scratch coat and keep moist during curing period. Mix scratch coat in proportion of one part by volume portland cement to 1/2 part by volume hydrated lime, and five parts by volume damp loose sand. Apply leveling coat over scratch coat with same mix when surface is not level within the specified tolerance or when base coat thickness of more than 20 mm is required. Scratch and cure leveling coat for not less than 24 hours.] [Scratch coat for wall tile backing is specified in Section [_____, "_____."]

]2.1.16 Metal Lath

UNI EN 10142, steel grade equal to FePo3G with zinc coating designation of Z200.

2.1.17 Cementitious Backer Units

Concrete glass fiber reinforced, 13 mm thick prefabricated panel, consisting of aggregate portland cement reinforced with vinyl-coated woven glass-fiber mesh embedded in both surfaces. Panels shall have the following characteristics:

a. Maximum variation from length or width of $\pm$ 0.318 mm in the size of one panel

b. Support no growth of fungus or bacteria

c. Square shape or rectangular shape with square edges and corners

d. Maximum variation of thickness $\pm$ 0.8 mm

2.1.17.1 Glass Fiber Tape

Coated glass fiber tape [with pressure sensitive adhesive], 50 mm wide.

PART 3 EXECUTION

3.1 EXAMINATION

Do not start tile work until roughing in for plumbing, heating, ventilating, air conditioning, and electrical work has been installed and tested; and built-in bathtubs, shower stalls, and membrane waterproofing have been installed and tested.

3.2 PREPARATION

3.2.1 Concrete Subfloor Preparation

Do not begin floor tile installation in areas receiving wall tile until wall tile installation has been completed.

3.2.1.1 Precast and Structural Slabs Subject to Bending

****

NOTE: Reinforced mortar setting and precast

concrete floor beds with cleavage membrane should be used over structural floors subject to bending and deflection.

****

****

NOTE: The curing and finishing requirements for concrete surfaces that are to be tiled should be included in Section 03300, "Cast-In-Place Concrete."

****

****

NOTE: Designer shall specific expansion joints and show location and details on drawings.

****

Use reinforced mortar setting bed with cleavage membrane.

3.2.1.2 Sub-Surface Inspection and Conditions

a. Sub-Surface Requirements

Prior to commencing ceramic tilework, the Contractor shall inspect surfaces to receive title and accessories and shall notify the Officer in Charge of Construction in writing of any apparent defects or conditions that will prevent a satisfactory tile installation. Installation work shall not proceed until satisfactory conditions are provided which include:

(1) All surfaces shall be clean, dry, structurally sound, free of dust, oily or waxy films and all foreign matter. Concrete surfaces shall be free of form oil, curing compounds and laitance.

(2) Concrete floors shall be screed-finished for application of bonded portland cement mortar bed, but steel-trowel finished if a cleavage membrane is used under the mortar bed. If tile is to be bonded directly to concrete floor with one of the thin-set methods the slab shall have a steel trowel and fine broom finish.

(3) Grounds, anchors, plugs, hangers, floor frames, electrical, mechanical, and other work in our behind tile shall be installed before the work is started.

3.2.1.3 Sub-Surface Tolerance Requirements

Sub-surface to receive tile shall be plumb, level and true with square corners. Provide complete sub-surface inspection to assure that the following maximum variations from required plane have been met by sub-surface construction prior to the start of the installation.

a. Portland cement mortar

(1) Sub-floor surface 6 mm in 3 m

(2) Wall and ceiling surfaces 7.5 mm in 3 m

b. Dry-set or Latex Portland Cement Mortar Bed

(1) Sub-floor surface 3 mm in 3 m

(2) Vertical surface 3.75 mm in 3 m

c. Epoxy Adhesive

Sub-floor surfaces

(1) 2 mm in 1 m abrupt. Irregularities of more than 1 mm will not be acceptable.

(2) Walls and ceilings 3.75 mm in 3 m

3.2.2 Preparation of Mortar Mixes

Measure mortar materials in approved containers to ensure that proportions of materials will be controlled and accurately maintained. Measuring materials with shovels is not permitted. Unless specified otherwise, mix mortar in proportions by volume in approved mixing machines or mortar boxes. Control the quantity of water accurately and uniformly.

3.3 INSTALLATION

3.3.1 Installation

3.3.1.1 Tile Installation

Installation of tile includes base, wainscots, window stools, reveals, and accessories and as required for a complete installation.

a. Soak tile in clean water for at least 1/2 hour and drain excess water before setting. Immerse each tile completely during the soaking period. Resoak and drain tiles that exhibit drying along the edges before setting. Free moisture shall not remain on the backs of the tile when they are being set. (Vitreous tile, glazed or unglazed, need not be soaked.)

b. When a bond coat of dry-set mortar or latex portland cement mortar is used with tile, the tile should not be soaked.

c. Before setting sheets of face-mounted tile on vertical surfaces, fill the joints with spacing mix.

d. Apply a 1 to 2 mm thick bond coat over the mortar bed while still workable. If white joints are required, a white bond coat shall be used.

e. Back each tile with bond coat prior to firmly pressing it into position and beat-in.

f. Set tile firmly on the mortar bed. Lugs on tile determine the

joint width between tile. Spacers, string or rope shall be used to space tile that have no lugs. Bring all surfaces to a true plane at the proper position or elevation. Thoroughly beat-in all tile while the mortar bed is still workable. The beat-in shall fill the entire space between ribs of tile with mortar.

g. After removing the paper from face-mounted tile set on horizontal surfaces, fill joints with spacing mix. Gently rub the tile with a wooden block to work tile into an even plane while mortar is still workable.

h. Make adjustment of tile before initial set of the mortar takes place.

i. Provide all metal wall studs to receive attached lathing with a minimum of 0.85 mm wall thickness.

j. Provide polyethylene membrane (free of holes or breaks) lapped in shingle fashion for all installations requiring metal lathing or glass mesh mortar units. Provide 50 mm minimum laps at all joints of membrane.

k. Lap metal lath a minimum of 50 mm at sides and ends where sheets are joined. Lap preassembled membrane and metal lath metal to metal and membrane to membrane. Lap wire fabric one full mesh, wire to wire, where joined.

l. Extend lath in showers to within 50 mm of floor and lap over the shower pan. Nails in lath shall not be placed below top of shower pan.

m. Utilize the same type of mortar and grout for each tile installation.

3.3.1.2 Workmanship, Cutting and Fitting

a. Center and balance edge areas of tile.

b. No cuts smaller than half size should be made. Make all cuts on the outer edges of the field.

c. Smooth cut edges. Install tile without jagged or flanked edges.

d. Fit tile closely where edges will be covered by trim, escutcheons or other similar devices.

e. The splitting of tile is expressly prohibited unless approved by the contracting officer.

f. Maintain the heights of tilework in full courses to the nearest obtainable dimension where the heights are given in mm.

g. Make corners of all tile flush and level with corners of adjacent tile.

h. Thoroughly back-up with thin-set bonding material all thin-set trim units, molded or shaped pieces and secure firmly in place.

i. Thoroughly back-up with mortar-bed mix and secure firmly in place all thick-bed nosings, covers, curbing, gutters, flat tile and trimmers, molded or shaped pieces.

j. Bond coat mix shall not be used to back-up thick bed trim and angles. Coat all thick-bed trim shapes with 1 to 2 mm of bond coat mix.

k. Install accessories in tilework to be evenly spaced properly centered with tile joints, and level, plumb and true to the correct projection. Install accessories at locations and heights designated.

l. Finished tilework shall be clean. Pitted, shipped, cracked and scratched tiles shall be replaced.

3.3.1.3 Joint Width

Make joints uniform in width and space to accommodate tile with a minimum of cutting, but maintain standard mounting widths between units abutting sheets of mounted ceramic mosaic tile. Make joint widths as follows:

a. Mounted Tile: As determined by the mounted tile spacing.

b. Unmounted Glazed Wall Tile: As determined by spacing lugs.

c. Quarry tile: 6 mm minimum, width of 10 mm maximum.

d. Trim units and accessaries: Match adjoining tile units.

3.3.1.4 Expansion and Control Joints

a. Insert preformed joint filler or back-up material in joints to proper depth to provide correct cavity depth for sealant.

b. Prior to grouting, keep joints open and clean by stuffing with paper or other material to prevent filling with dirt, grout, or mortar.

c. After tile is grouted and completely dry, remove paper or other temporary filler material; brush joints clean and fill with back-up material and sealant as specified in Section 07920, "Joint Sealants."

d. Provide expansion joints in the tile work aligned with structural joints in the substrate or provide a cleavage membrane between the substrate and tile to offset from structural joint.

3.3.1.5 Grouting Tile Work

a. Mixing Grout

(1) Dry blending of an entire container of commercial portland cement grout, dry-set grout, or the powder portion of a latex-portland cement grout prior to mixing the material with water or latex. For large areas, dry mixing several bags together, in a power mixer.

(2) Mix grout in accordance with manufacturer's printed instructions.

b. Installing Grout

(1) Dampen dry joints prior to grouting with commercial portland cement, dry-set, and latex-portland cement type grouts. Do not leave puddles of water in the joints before grouting.

(2) Force a maximum amount of grout into the joints. All grout joints shall be filled with grout material a minimum of 2/3 of the thickness of the tile used.

(3) All grout joints shall be uniformly finished. Cushion edge tile shall be finished evenly to the depth of the cushion.

c. Cleaning: See appropriate grout specification and/or manufacturer's recommendations for cleaning of tile after grouting. Acid cleaning of unglazed tile, when necessary, shall not be sooner than 14 days after setting tile. Final clean-up shall be done by finishing or polishing with a terry cloth or similar pad

d. Curing: All commercial portland cement, sand-portland cement, and dry-set grouts shall be damp cured for 72 hours minimum. Cover floor with 1.45 kilogram/sq. m natural kraft paper with joints overlapping at least 100 mm and tape sealed or held down with planks or other weights.

e. Provide [White] [_____] color grout for walls and [Gray] [_____] grout for floors. [Factory premixed colored grout.]

[3.3.2 Portland Cement Mortar

Portland cement mortar: [ceramic mosaic], [quarry] [paver] tile, [and reinforced mortar bed] [and cleavage membrane]. Recess, or depress setting bed where indicated. [Waterproofing for [_____] is specified in Section [_____].

****

NOTE: In lieu of the conventional mortar method, floor and wall tile may be installed by the dry-set mortar method, the epoxy mortar method, or the latex-portland cement method. However, these methods are not recommended for use directly over precast concrete flooring systems.

****

****

NOTE: Bonded mortar setting beds should only be used on slab-on-grade construction where no bending stresses occur or on structural slabs of limited area.

****

`3.3.2.1 Application of Floor Tile with Portland Cement Mortar

a. Mortar Bed: Provide a depressed floor slab to level surface of tile with adjoining floor surfaces unless otherwise indicated. Make the mortar bed water-resistant by using an admixture. Mix and use this material in strict accordance with manufacturers directions.

(1) After mixing with water, the mortar shall be of such consistency and workability that will allow maximum compaction during tamping of the mortar bed.

(2) In areas with floor drains, the waterproof membrane shall be installed over a slope of 21 mm per meter to the drain weep holes.

(3) Place reinforcement in the center of the mortar bed. Reinforcement shall not butt against vertical surfaces.

(4) Provide minimum thickness of mortar bed of 44 mm at drains or as required by local plumbing code.

(5) The high point to the floor shall be not less than 50 mm or more than 225 mm below the top of a finished dam and the mortar fill, waterproof membrane and finished floor shall be a minimum of 21 mm/m pitch toward the drain per foot.

(6) When hand mixing, thoroughly mix dry mortar ingredients before adding water to obtain proper consistency. When machine mixing, add water first. Discard mortar when it has reached its initial set.

b. Application of Mortar to Concrete Floors and Decks: Unless otherwise specified, place and bond the mortar bed to concrete slab as follows:

(1) Dampen clean, properly prepared concrete surface with water immediately prior to placing the bonded mortar bed. Concrete surface to be completely free of standing water.

(2) Before placing mortar bed, spread a very thin continuous coating of pure portland cement slurry on the concrete surface or dust a thin layer of dry portland cement on the concrete and wet it. Broom the pure portland cement slurry of the wetted portland cement dust to completely coat the concrete surface with a thin and uniform coating.

(3) Immediately apply mortar bed over the pure cement coating. Firmly tamp and screed mortar bed. Mortar bed thickness shall be a nominal 32 mm.

c. Application of Mortar Bed Over Cleavage Membrane and for Shower Receptor: On wood subfloors, countertops, coated concrete, waterproof membranes, and when a cleavage membrane over concrete is specified, place the mortar bed as follows:

(1) Place a cleavage membrane over the substructure, lapped at least 102 mm at joints, except when a water-proof membrane installed by others is already in place (as in a shower receptor or roof deck.)

(2) Place wire reinforcing and mortar bed over the membrane. Lap reinforcing at least one full mesh and support so that reinforcing shall be approximately in the middle of the mortar bed. Reinforcing shall not butt against vertical surfaces.

(3) Place, tamp firmly, and screed the mortar bed level, with proper slope to drain. Mortar bed thickness shall be a minimum 32 mm except for countertop and shower receptors.

3.3.2.2 Application of Wall Tile with Portland Cement Mortar

a. Scratch and Covering Coat

(1) When hand mixing, thoroughly mix dry mortar ingredients before adding water to obtain proper consistency. When machine mixing, add water first. Discard mortar when it has reached its initial set.

(2) Over clean concrete block walls, scratch coat may be omitted and the title setter's mortar bed, not to exceed 19 mm thick, may be used directly over the properly dampened block surface.

(3) Apply scratch coat to lath or to prepared, clean masonry, bushhammer or heavy sandblast concrete surfaces for a degree of roughness to provide mechanical bond.

(4) Cure scratch coat for at least 24 hours before applying leveling coat.

(5) Apply leveling coat over scratch coat when its surface varies more than 7.25 mm in 3 m from the required plane, or when mortar bed thickness of more than 19 mm is required to build out to finished tile surface.

(6) When a leveling coat (plumb scratch) over the scratch coat is specified, scratch and cure it at least 24 hours dependent upon climate conditions.

][3.3.3 Dry-Set and Latex-Portland Cement Mortar

3.3.3.1 Mixing Dry-Set and Latex-Portland Cement Mortars

a. Mixing Dry-Set Mortars

(1) Mix dry-set mortars in accordance with the following directions, unless mortar manufacturer's instructions differ.

(2) Add dry ingredients to recommended amount of water. Mix slowly and thoroughly and let mortar stand for 15 minutes, then remix. Do not speed mix. Do not add water, additional mortar, or other ingredients after slaking period.

(3) Mortar consistency shall be such that when applied with the recommended notched trowel to the backing the ridges formed in the mortar shall not flow or slump.

(4) During use, remix mortar occasionally. Do not add water or fresh materials shall not be added after initial mixing. Mortar shall not be remixed and used after initial set.

b. Latex-Portland Cement Mortar

(1) Mix latex-portland cement mortars in accordance with latex manufacturer's instructions or as modified herein.

(2) Use the brand of prepacked dry mortar mix specified by the latex manufacturer.

(3) Add dry mortar mix to amount of latex specified by manufacturer and mix thoroughly to obtain complete and visually uniform wetting of the dry mortar mix. Slake for 15 minutes and remix before using.

(4) Latex portland cement thin-set mortars are available in two forms. Both are dry mixes with one requiring the addition of liquid latex when mixing. In this instance, follow the liquid latex manufacturer's instructions. The second form is a factory blend of dry power and dry polymers that requires only water be added when mixing. In this case, follow the mortar manufacturer's instructions.

(5) The proper mortar consistency is such that when applied with the recommended notched towel to the backing, the ridges formed in the mortar will not flow or slump.

(6) During use, remix mortar occasionally. Do not add water or fresh materials after initial mixing. Mortar shall not be remixed and used after initial set.

3.3.3.2 Installation of Floor, Wall and Ceiling Tile with Dry-Set or Latex Portland Mortar

Install of floor tile over a cement mortar bed, properly prepared concrete slabs or properly prepared cementitious backer units.

a. Mortar Bed

(1) Clean surface thoroughly. Dampen if very dry, but do not saturate.

(2) Apply mortar with flat side of trowel over an areas no greater than can be covered with tile while mortar remains workable. Using a notched trowel of type recommended by mortar manufacturer, comb mortar to obtain even setting bed without scraping backing material. Cover surface uniformly with no bare spots with sufficient mortar to insure a minimum mortar thickness of 2 mm between tile and backing after tile has been beaten into place. Tile shall not be applied to skinned over mortar.

(3) Insert filler material in expansion and control joints.

b. Quarry, Paver and Ceramic Tile

(1) Press tile into freshly combed mortar, insuring mortar contact with tile while maintaining accurate joint alignment and spacing. Keep a minimum of 2/3 of joint depth open for grouting.

(2) Thoroughly beat all tile or tile assemblies into place to obtain maximum contact of bonding mortar on the back of each tile, or back of each tile and back mounting material. Average uniform contact area shall be not less than 80 percent except on exterior or shower installations where contact area shall be 100% when no less than three tiles or tile assembles are removed for inspection. The 80 percent coverage shall be sufficiently distributed to give full support to the tile with particular attention to this support under all corners of the tile.

(3) Obtain 100 percent contact with tile by trowelling a layer of mortar on the back of each tile prior to placing on the combed mortar bed.

][3.3.4 Chemical-Resistant Water-Cleanable Tile-Setting and Grouting Epoxy

3.3.4.1 Mixing Chemical Resistant Water Cleanable Tile-Setting and Grouting Epoxy

a. Store epoxy material at a temperature of 20 to 32 C for a period of 48 hours prior to use.

b. Epoxies are supplied as two or more separate parts that shall be mixed together on the job at the time of use. Separate parts shall be proportioned exactly and mixed thoroughly.

c. Follow the manufacturer's directions for proportioning and mixing of the epoxy, including pre-mixing of separate parts before combination, when required.

3.3.4.2 Installation of Tile with Epoxy

a. Tile shall not be set in epoxy on wet surface unless specifically authorized by the epoxy manufacturer.

b. Apply epoxy with flat side of trowel to completely cover substrate. Using a notched trowel of type recommended by epoxy manufacturer, comb epoxy to obtain an even setting bed without scraping substrate. After beating in, achieve an average thickness of 1.6 mm for ceramic mosaic tile and 2 mm for quarry tile, paver tile and packing house tile.

c. Apply only amount of epoxy that can be covered with tile before initial set. Temperature affects set times. Test sections should be tried before tiling large areas.

d. Spacing mix shall not be used between tiles.

e. Comply with epoxy manufacturer's directions.

f. Unless otherwise specified, press tile firmly into position and beat-in or vibrate to obtain at least 80 percent coverage of epoxy on the back of each tile.

g. Use spacers when necessary on vertical backings to maintain even joint width.

h. Prior to installing tile, remove epoxy from the substrate that has taken an initial set and replace with fresh epoxy.

i. Remove paper and glue from mosaic tile that is face mounted within one hour after tile is set and adjust all tiles that are out of line or level. Use no more water than necessary in removing paper.

j. Immediately remove any epoxy from the face of tile.

3.3.4.3 Grouting of Tile with Epoxy

a. Before grouting, all tiles must be firmly set, all paper and glue removed from face of mounted tiles, and all spacers, strings, ropes and pegs removed.

b. Grouting shall be done n accordance with the manufacturer's instructions.

c. Allow 16 hours curing time for tile before grouting tile set in epoxy.

d. Force epoxy into joints using a hard rubber grouting trowel or other suitable tool recommended by epoxy manufacturer. Use sufficient pressure and flow epoxy in progressively to avoid air pockets or voids. Joints grouted with epoxy shall be filled flush with tile edges. Provide a contoured depression no deeper than 1 mm for a 6 mm wide joint, and 2 mm for a 10 mm wide joint. Grout all joints to at least 2/3 of the joint depth.

e. Remove all excess epoxy from surface of tile with a squeegee or rubber trowel before it loses its plasticity or begins to set. Immediately perform final clean-up in accordance with epoxy manufacturer's directions.

f. Epoxy shall not be allowed to harden on face of tile.

g. Joints grouted with epoxy shall be filled flush with tile edges. Provide a contoured depression no deeper than 1 mm for a 6 mm wide joint, and 2 mm for a 10 mm wide joint.

]3.3.5 Cementitious Backer Units

3.3.5.1 Installation

****
NOTE: Use of glass mesh mortar units is limited to walls where lightweight construction is a factor. Suitable backings include wood or 0.9 mm thick or heavier metal studs spaced at not more than 400 mm on-centers.
****

Install horizontally, with end joints over framing members. Secure to each framing member with screws spaced not more than 200 mm on center and not closer than 10 mm from the edge. Install polymer coated screws with heads flush to the surface of the board.

3.3.5.2 Joint Treatment

Fill horizontal and vertical joints and corners with either organic adhesive, dry-set portland cement, or latex-portland cement mortar. Apply glass fiber tape over joints and corners and embed with same mortar or adhesive.

3.3.6 Metal Dividing Strips

Install dividing strips in mortar setting bed while bed is in a plastic state. Set dividing strips where indicated in straight, unbroken lines, flush with unfinished floor surface. Provide dividing strips at joints where floor tile abuts and is flush with other types of floor finishes, except at doors where thresholds are provided.

3.3.7 Thresholds

Align edges with faces of trim on both sides of openings. Fit thresholds neatly and bed properly in cement mortar flush with adjoining floors.

3.4 CURING AND PROTECTION

Protect tiled areas from damage during the remainder of the project work. Cover finished tile floors with clean, 1.45 kilogram/sq m natural kraft paper before permitting foot traffic. Overlap kraft paper joints a minimum

of 100 mm and and seal joints with tape. Place board walkways on floors that are to be continuously used as passageways by workers. Cover marble stools and thresholds with boards. Protect tiled corners, external angles, with board corner strips in areas used as passageways by workers.

3.4.1 Curing of Tile with Epoxy Grout

Keep installation at a temperature of 18 to 29 C during the first 8 hours of cure. Shade area completely from sun during this period. Before, during and after grouting, the area must be kept clean, dry and free from foreign materials such as construction, dirt, portland cement, plaster and other contaminants which could interfere with the setting and curing of the epoxy.

-- End of Section --